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PUBLICATIONS AND PATENTS

July-December 1972

**Agricultural Research Service
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Northern Regional Research Laboratory
Agricultural Research Service
United States Department of Agriculture
1815 North University Street
Peoria, Ill. 61604

REQUEST FOR INFORMATION

Results of research investigations at the Northern Regional Research Laboratory are published regularly in the technical literature, and public-service patents are secured to cover patentable inventions and discoveries (see page 54). As a convenient guide to our publications and patents, a list with abstracts is published semiannually. These abstracts describe the current research and indicate the progress achieved. Further information on any of the developments, as well as earlier technical papers, may be obtained by writing us.

In conformance with the policy of the U.S. Department of Agriculture, Northern Laboratory publications are available to scientists and other specialists, librarians, representatives of the press, and others interested.

Reference to commercial equipment or proprietary products is made as part of the exact experimental conditions. Naming a company or product does not imply approval or

recommendation by the U.S. Department of Agriculture over others not mentioned.

Requests for specific reprints should be by number and addressed to the Northern Regional Research Laboratory. Those titles marked with an asterisk [*] are not available at the Northern Laboratory for distribution.

Most of the publications are in journals that are available in libraries. Photographic copies of most journal articles on research at this Laboratory can be purchased from the National Agricultural Library of the U.S. Department of Agriculture, Beltsville, Maryland 20705.

No publications will be sent regularly in response to foreign requests unless exchange arrangements have been made with the Director of the National Agricultural Library.

Copies of previous lists of publications and patents are available upon request.

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PUBLICATIONS

[Publications marked with an asterisk (*) are not available for distribution at the Northern Regional Research Laboratory. When requesting reprints, please order by number. Use your zip code.]

- 3158 • Hydrocarbons in Haemolymph from Healthy and Diseased Japanese Beetle Larvae
Glenn A. Bennett, Robert Kleiman, and Odette L. Shotwell
J. Insect Physiol. 18(7): 1343-1350. July 1972

The hydrocarbons in extractable lipids of haemolymph from healthy and diseased larvae of the Japanese beetle (*Popillia japonica*) have been characterized. Haemolymph contains at least 21 saturated hydrocarbons having from 21 to 27 carbon atoms. Normal, monomethyl-branched, and dimethyl-branched alkanes with even and odd carbon numbers were identified. Tricosane (12%), 11-methyltricosane (19%), 9,13-dimethyltricosane (27%), and 11-methylpentacosane (11%) are the major hydrocarbons. Haemolymph from third instar larvae contains at least six minor hydrocarbons that could not be obtained in sufficient quantities for structure identification. The total amount of hydrocarbons per milliliter is reduced in haemolymph from larvae infected with *Bacillus popilliae*; however, the relative concentration of each hydrocarbon is not significantly changed as a result of infection.

- 3159 • The Abundance of *cis*-5-Octadecenoic Acid in *Dioscoreophyllum cumminsii* Seed Oil
G. F. Spencer and F. R. Earle
Lipids 7(6): 435-436. June 1972

Oil from *Dioscoreophyllum cumminsii* (Stapf) Diels contains *cis*-5-octadecenoic acid as 84% of its total fatty acids. The unsaturated acids normally found in seed oils are present in small amounts (oleic, 1%; linoleic, 5.2%; and linolenic, 0.3%). Other unusual acids present, in minor amounts, are *cis*-5-hexadecenoic (0.6%), 11-octadecenoic (0.9%) and two polyenoic acids, which are probably unsaturated at the 5 position.

3160 • Solid State Fermentations

C. W. Hesseltine

Biotechnol. Bioeng. 14(4): 517-532. July 1972

A unique method is described by which large yields of secondary metabolites are produced on solid substrates. The process involves moist substrates continuously agitated in appropriate fermentation equipment. The amount of agitation, aeration, and moisture can be varied. Yields of secondary metabolites, such as ochratoxin and aflatoxin, were extremely high when *Aspergillus* and *Penicillium* species were used. The process prevents sporulation of the fungus and, because of the nature of the solid substrate, makes recovery of the product easier than in conventional liquid media. Possible substrates include rice, corn, wheat, and other cereals.

3161 • Polyamines in Soybeans

L. C. Wang

Plant Physiol. 50(1): 152-156. July 1972

Putrescine, spermidine, and spermine were three main polyamines isolated from soybeans and partially characterized. Occurrence of polyamines in soybeans was established by separating trichloroacetic acid extracts of soybeans by cationic exchange column chromatography, identification with thin-layer chromatography, paper electrophoresis, mass spectral analysis, reactions with ninhydrin and Dragendorff reagents, and spectrophotometric characteristics. Soybeans contained a minimum of 29.0 micrograms of polyamines per gram of full-fat flour. The alcohol-soluble fraction of soybeans contained polyamines also. Resting seeds contained spermidine in higher concentration than either putrescine or spermine. Spermine appeared to be present in lowest concentration. Preliminary experiments suggested that some polyamines were possibly in bound forms.

3162 • Oats and Their Dry-Milled Fractions: Protein Isolation and Properties of Four Varieties

Y. Victor Wu, Kenneth R. Sexson, James F. Cavins,
and George E. Inglett

J. Agr. Food Chem. 20(4): 757-761. July-August 1972

Four varieties of oats were dry-milled into break flour, reduction flour, shorts flour, shorts, bran, and hulls. The three flour fractions have protein contents not much different from those of the whole oats, but the shorts and bran fractions have about double the protein content of whole oats. The 1 M NaCl extract accounts for a large percentage of total nitrogen from all fractions, whereas, the 0.1 N acetic acid extract represents a major part of the protein from the three flour fractions. Wyndmere whole oats, as well as its break flour, reduction flour, and shorts flour, have high lysine content (4.5-4.8 g./16 g. of N) and almost the same amino acid composition. The water-soluble protein has high lysine (8.1 g./16 g. of N) and half cystine (5.4 g./16 g. of N), and the residue has high lysine and methionine (4.1 g./16 g. of N).

- 3163 • Grain Sorghum Glutelin: Isolation and Characterization
 Alfred C. Beckwith
 J. Agr. Food Chem. 20(4): 761-764. July-August 1972

Glutelin accounts for more than half of the total protein content in three grain sorghum hybrid flours. A procedure has been developed to isolate this major fraction of highly insoluble proteins. Changes in glutelin solubility, gel electrophoretic, and chromatographic properties accompanying the cleavage of protein disulfide bonds are described.

- 3164 • Rotenone and Deguelin in *Tephrosia vogelii* at Several Stages of Maturity
 James W. Hagemann, Maerean B. Pearl, Joseph J. Higgins,¹
 Norman E. Delfel, and Fontaine R. Earle
 (¹Plant Sci. Res. Div., U.S. Dept. Agr., Glenn Dale, Md.)
 J. Agr. Food Chem. 20(4): 906-908. July-August 1972

Changes in rotenone (R) and deguelin (D) concentrations were followed by thin-layer densitometry in the leaflets and other parts of two lines of *Tephrosia vogelii* Hook. f. In one line, relatively free of R, total leaflet D increased from 1.6 to 3.2%. In the other line leaflet R increased with plant age from 0.3 to 1.1% and leaflet D increased from 1.1 to 1.9%. Rotenoid levels were higher in leaves formed later in the growing season but remained essentially constant in a given leaf throughout its life on the plant. Concentrations of rotenoids on the other plant parts were substantially lower and increased little or none as the plant matured. Abscission of lower leaves and increase in stem-to-leaf ratio combined to reduce the total rotenoid content of the whole plant late in the season.

- 3165* • The Effect of Tremortin A on Chickens
 Roger D. Wyatt,¹ Pat B. Hamilton,¹ W. M. Colwell,¹
 and Alex Ciegler
 (¹North Carolina State University, Raleigh)
 Avian Diseases 16(2): 461-464. January-March 1972

Tremortin A, a mycotoxin produced in feedstuffs by *Penicillium palitans* and other penicillia, causes tremors in chickens. The tremors were not elicited in day-old chicks but were caused in chicks that were three days old or older. The tremors were of low frequency and high amplitude and resembled those seen in Gumboro disease rather than those seen in avian encephalomyelitis.

- 3166 • Survey for Fusaria That Elaborate T-2 Toxin
H. R. Burmeister, J. J. Ellis, and C. W. Hesseltine
Appl. Microbiol. 23(6): 1165-1166. June 1972

Of the 136 strains of *Fusarium* examined, T-2 toxin was confirmed by thin-layer chromatography in 13 of the 21 extracts that inhibited either *Rhodotorula rubra* or *Penicillium digitatum*.

- 3167 • Acid-Modified Wheat Flours. Pasting and Dispersion Properties
J. C. Rankin, Margaret M. Holzapfel, C. R. Russell, and
C. E. Rist
Staerke 24(6): 187-191. June 1972

Acid-modified (AM) and hydroxyethylated acid-modified (HEAM) wheat flours were prepared with viscosities suitable for use as tub-sizing agents and as coating adhesives for paper. The pasting characteristics and dispersion properties of both these flours were compared with those of commercial products now used in such applications. Effects were determined of time, temperature, and solids concentration on pasting characteristics, paste viscosity, and dispersion properties.

Paste viscosity behavior of the modified flours, prepared under dry-state reaction conditions, was more like that of hypochlorite-oxidized (HO) starch than either AM or HEAM starches. Dispersibility of the modified flours was comparable to that of AM starch, but it was somewhat lower than dispersibility of HEAM and HO starches. Pastes of modified flours and starches, stored and periodically tested, varied little in dispersibility values for flour dispersions, whereas progressively less dispersible material was found in starch pastes.

- 3168 • Dialdehyde Starch in Paper Coatings Containing Soy
Flour-Isolated Soy Protein Adhesive
F. B. Weakley, M. E. Carr, and C. L. Mehltrittter
Staerke 24(6): 191-194. June 1972

A combination of soy flour and isolated soy protein was investigated as an adhesive in pigmented paper coatings that contained dialdehyde starch (DAS) as the insolubilizing agent. A coating formula of 50% solids made up of 8.3 parts soy flour, 8 parts isolated soy protein, and 0.5 part DAS per 100 parts of clay exhibited pseudoplastic and thixotropic flow properties characteristic of coating colors containing more costly protein adhesives. Both wax pick and wet-rub resistance of the paper coating were improved and putrefaction retarded by the use of DAS in the formulation. Brightness, wax pick, and wet-rub resistance values compared favorably with those of a reference coating containing 12.5 parts of isolated soy protein and 0.5 part DAS per 100 parts of clay.

3169 • Useful Properties of Maltose

J. E. Hodge, J. A. Rendleman, and E. C. Nelson
Cereal Sci. Today 17(7): 180-184, 186-188. July 1972

Technology is now available for preparing starch hydrolyzates that contain 90% or more maltose. Maltose should be a desirable sugar from a physiological standpoint. Its sweetness is low in water solutions, but the quality of its sweetness is high. Sweeter carbohydrates are obtained from maltose by isomerization to maltulose or by reduction to maltitol. Solubility and hygroscopicity properties of maltose vary widely with its purity and anomeric composition. Maltose forms complexes with many polar organic compounds. To promote markets for maltose, we have shown that 90% syrups can be readily crystallized in a new stable, anhydrous, high-melting form that contains from 75 to 80% α -maltose and from 20 to 25% β -maltose.

3170 • Brassidic Acid: Preparation from Erucic Acid and Mechanism of Elaidinization

Shu-Pei Chang and Thomas K. Miwa
J. Amer. Oil Chem. Soc. 49(7): 422-425. July 1972

Brassidic acid was prepared by elaidinization of 95% erucic acid with 4 mole percent nitrous acid at 70° C. for 30 minutes, followed by crystallization from 95% ethanol. Yield was 70%, and purity was 96 to 97% by gas liquid chromatography and thin layer chromatography. The isomerization reaction was monitored by infrared *trans* absorption for optimal reaction rate and yield. There was no migration of the double bond. The nuclear magnetic resonance spectrum of the *trans* protons was wide and complex with a chemical shift of 5.34 δ . The nitrous acid elaidinization, generally explained as a free radical process, is believed to be induced initially by the nitrogen dioxide anion (nitrite) and followed immediately by complex formation between the excited triplet anion and the olefin. The complex rotates to the opposite geometric configuration driven by a spin-orbital coupling process.

3171 • The Interface Between Reactive Pigment and Binder Matrix

R. L. Eissler and L. H. Princen
J. Electroanal. Chem. 37: 327-336. 1972

A quantitative method has been developed to use the scanning electron microscope in investigating the interface between a reactive pigment and a binder matrix. Free films were prepared from a bodied linseed oil, driers, and a 30% pigment volume concentration of either of two zinc oxide pigments. Specimens of each film were fractured in tension on an Instron tester after one of three treatments: (1) 6 weeks aging in a laboratory atmosphere; (2) aging in distilled water for 6 weeks followed by fracture while water-soaked; or (3) aging in distilled water for 4 weeks followed by drying in the laboratory atmosphere for 2 weeks. Distributions of apparent

diameter and number of pigment particles exposed per unit area of fracture surface were determined from measurement on 6,000X to 15,000X photomicrographs. Comparison of distributions using a Chi square test allowed evaluation of film treatments.

- 3172 • Wheat Gluten Subunits: Molecular Weights Determined by Sodium Dodecyl Sulfate-Polyacrylamide Gel Electrophoresis
J. A. Bietz and J. S. Wall
Cereal Chem. 49(4): 416-430. July-August 1972

Polyacrylamide-gel electrophoresis in the presence of sodium dodecyl sulfate (SDS) has revealed the number and molecular weight (MW) of the different-sized subunits obtained from gliadin and glutenin after reduction of disulfide bonds. Most proteins in gliadin are single-chained and have MW's near 36,500. The whole gliadin fraction also contains 11,400-MW polypeptides which may be albumins, a major polypeptide of MW 44,200, and Ω -gliadins of MW's 69,300 and 78,100; trace amounts of other polypeptides are also present. The 44,200-MW polypeptides, along with some of MW 36,500, are joined through disulfide bonds into higher-MW proteins. Glutenin consists of polypeptides of at least 15 unique MW's ranging from 11,600 to 133,000; two glutenin subunits correspond in mobility to the major gliadin polypeptides. Since disulfide cleavage and denaturation are complete and since no other labile cross-links can be detected, these polypeptides may represent the fundamental structural units of glutenin. Equilibrium-dialysis data establish that the amounts of SDS bound to gluten proteins and standards are similar, supporting the MW values obtained for gliadin and glutenin. In addition to determining MW distribution and number of gluten subunits, SDS-polyacrylamide gel electrophoresis can monitor column separations, serve as a criterion of purity, and detect differences in subunit composition of glutenins of different varieties.

- 3173 • Aflatoxin Contamination: Association with Foreign Material and Characteristic Fluorescence in Damaged Corn Kernels
Odette L. Shotwell, Marion L. Goulden, and C. W. Hesseltine
Cereal Chem. 49(4): 416-430. July-August 1972

Samples of corn from commercial markets, previously shown to contain aflatoxin, were examined to determine the distribution of toxin within the bulk of the corn. A greenish-gold fluorescence under ultraviolet light (365 nm) was associated with the presence of aflatoxin. Damaged kernels with the characteristic fluorescence contained as high as 88,500 to 101,000 p.p.b. aflatoxin B₁, indicating that the toxin contamination could be concentrated within a few kernels in a corn sample. In two of thirteen contaminated corns examined, aflatoxin B₁ was found in high concentrations in the broken corn-foreign material, accounting for most of the toxin in the total sample of corn.

- 3174 • Dry-Milling of Corn Attacked by Southern Leaf Blight
O. L. Brekke, A. J. Peplinski, E. L. Griffin, Jr.,
and J. J. Ellis
Cereal Chem. 49(4): 466-478. July-August 1972

Southern corn leaf blight (caused by *Helminthosporium maydis* Nisik. et Miyake, Race T) did appreciable damage to the 1970 corn crop in the U.S. In addition to the reduction in crop yield, the damaged yellow dent hybrids tested usually were low in test weight and had excessive amounts of small, damaged, or moldy kernels. White corn lots had many of these same characteristics but to a lesser degree. Cleaning losses ran higher for blighted samples, and our cleaning procedure removed only some of the moldy kernels. No operating problems were encountered in laboratory-scale dry-milling tests. As test weight of the corn decreased, yield of the prime-product mix also decreased. Recoverable-oil yield varied with oil content of the corn. The prime products had acceptable fat contents but often had more dark specks and floury endosperm than products from unblighted corn. Presence of *H. maydis* usually was low in the prime products. No statistically significant differences in odor or flavor scores were noted between grits prepared from blighted corn and those from unblighted corn.

- 3175 • Dioxolane Configuration in Diastereoisomeric 1,2-*O*- and 1,2:4,6-Di-*O*-alkylidene- α -D-glucopyranose Derivatives by N.M.R. Spectroscopy
W. E. Dick, Jr., D. Weisleder, and J. E. Hodge
Carbohyd. Res. 23(2): 229-242. July 1972

Three related pairs of diastereoisomers, the previously unknown 3,4,6-tri-*O*-acetyl-1,2-*O*-ethylidene- and 3-*O*-acetyl-1,2:4,6-di-*O*-ethylidene- α -D-glucopyranoses, and the known 3,4,6-tri-*O*-acetyl-1,2-*O*-benzylidene- α -D-glucopyranose, were prepared by reduction of intermediate dioxolenium chloride ions with sodium borohydride. Each pair of isomers was separated into its components by preparative thin-layer chromatography. Four correlations of nuclear magnetic resonance parameters with dioxolane configuration were used to assign the structure of each isomer of a diastereoisomeric pair: (1) deshielding of the 2'-substituent when *endo*; (2) deshielding of H-2 or H-5 by bulky *exo* or *endo* 2'-substituents; (3) larger values of $J_{2,3}$ and $J_{3,4}$ when a bulky 2'-substituent has an *exo* orientation; and (4) the presence of long-range (4J) coupling of H-2 and H-4 of the pyranose ring only in molecules with a bulky 2'-substituent in an *endo* orientation. The degree to which the pyranose ring is distorted by the *cis*-fusion of a dioxolane ring in such derivatives, as well as by *endo* phenyl, methyl, and proton substituents, is evaluated.

- 3176* • Protein Chemistry and Photochemistry in Dimethyl Sulfoxide
Mendel Friedman,¹ L. H. Krull, and K. Eskins
(¹Western Regional Research Laboratory, Albany, Calif.)
Appl. Polym. Symp. No. 18: 297-306. 1971

Disulfide bonds (SS) in model proteins are rapidly reduced to sulfhydryl groups (SH) by sodium hydride (NaH) in dimethyl sulfoxide (DMSO) with negligible side reactions. However, the reagent also produces sites initiating anionic graft polymerization of vinyl monomers onto the protein. Such sites, including alpha carbon atoms and peptide nitrogen, can be demonstrated by alkylation.

DMSO modifies ultraviolet photolysis of proteins, inhibiting formation of SH. Loss of SS is least in about 75% DMSO. Sulfur from the solvent is incorporated into the protein, which in the case of gluten is not cleaved or aggregated. Styrene protects sulfur-containing amino acids from photolysis and undergoes light-initiated free-radical graft polymerization, deduced to occur at aromatic side chains rather than on main chain atoms.

- 3177* • PRNTZ - 1132 Printer Output Subroutine
Joseph O. Ernst
Proc. COMMON Meeting, Pittsburgh, Pa., Section III-9,
September 17-19, 1969. [Also published in IBM Systems
Reference Library Catalog of Programs, Hawthorne, N.Y.,
pp. 855-856. January 1971]

PRNTZ is an interrupt service subroutine written for an IBM 1130 computing system operating with the IBM 1130 disk monitor system, version 2, program number 1130-OS-005. The PRNTZ subroutine replaces the original subroutine. This new PRNTZ provides the user with increased speed of operation by overlapping the printing of the line with other operations, and by improving the print scan section to minimize unnecessary print scans.

- 3178 • *cis* and *trans* Analysis of Fatty Esters by Gas Chromatography: Octadecenoate and Octadecadienoate Isomers
E. A. Emken
Lipids 7(7): 459-466. July 1972

A gas chromatographic (GC) method has been developed for quantitative determination of the *cis* and *trans* percentages in octadecenoate and octadecadienoate esters. To separate *cis*- and *trans*-monoene and diene isomers on a packed GC column, the fatty esters were stereospecifically epoxidized with peracetic acid. A simple and quantitative epoxidation procedure allows the *cis*- and *trans*-epoxyoctadecanoates to be analyzed without prior isolation from the reaction mixture. No positional or geometric

isomerization of the double bond occurred during epoxidation. Synthetic mixtures containing *cis*- and *trans*-6, -9, and -12 octadecenoate isomers were completely separated into *cis* and *trans* fractions. *trans*-15-Octadecenoate was the only isomer investigated that partially interfered in the analysis. Diene mixtures containing *trans,trans*-, *cis,trans*-, and *cis,cis*-9,12-octadecadienoates were also successfully analyzed by gas liquid chromatography (GLC) after epoxidation with peracetic acid. Each diene isomer formed two pairs of diepoxy diastereomers, some of which could be separated. One *cis,cis*-diepoxyoctadecanoate diastereomer peak overlapped the *cis,trans*-diepoxyoctadecanoate peaks. The total *cis,cis*-diepoxyoctadecanoate percentages were calculated by using the ratio of the two *cis,cis*-diepoxyoctadecanoate diastereomers. Other positional octadecadienoate isomers were also epoxidized and analyzed by GLC. The large number of possible octadecadienoate isomers requires that some preliminary fractionation be made before GC analysis is practical for diene isomers.

- 3179 • Sensitized Photooxidation of α -Tocopherol and of 2,2,5,7,8-Pentamethyl-6-chromanol in Ethyl Acetate
G. W. Grams and G. E. Inglett
Lipids 7(7): 442-444. July 1972

The major product of each photooxidation was an equimolar mixture of quinone oxide and quinone. The yield of this mixture was 64% and 67% when the substrate was α -tocopherol and 2,2,5,7,8-pentamethyl-6-chromanol, respectively. Neither spirodienone dimer nor trimer was present in the product mixture. Evidently the reaction intermediate is an adduct of tocopherol and singlet oxygen. Tocopherol may protect biological lipids from singlet oxygen degradation.

- 3180 • *cis*-5-Monoenoic Fatty Acids in Some Chenopodiaceae Seed Oils
R. Kleiman, M. H. Rawls, and F. R. Earle
Lipids 7(7): 494-496. July 1972

Methyl esters from seed oils of four Chenopodiaceae species are unusual in that they contain methyl *cis*-5-hexadecenoate (4.6-12%) and methyl 5-octadecenoate (1.1-1.2%). There are indications of small amounts of 18:2^{5,9} and 18:3^{5,9,12} along with unsaturated acids commonly found in seed oils--oleic (14-21%), linoleic (53-57%), and linolenic (3.5-7.8%). Fatty acid composition of the oils was determined by gas chromatography, and positions of the double bonds were established by application of gas chromatography-mass spectrometry to the methoxylated methyl esters.

- 3181 • Crosslinked Poly(ester-acetals) as Polar, Stationary Phases for Gas Chromatography at Subambient-to-Moderate Temperatures
W. E. Neff, E. H. Pryde, E. Selke, and J. C. Cowan
J. Chromatogr. Sci. 10(8): 512-517. August 1972

Poly(ester-acetals) crosslinked and bonded to silanol groups of an acidic siliceous support provide novel stationary phases for gas chromatography. A particularly useful poly(ester-acetal) is one obtained by copolymerizing methyl azelaaldehyde pentaerythritol acetal (a spiro acetal diester), dimethyl 1,4-cyclohexanedicarboxylate and diethylene glycol. The temperature range for single column application with flame ionization detector is at least as low as -60° and up to 200° C., where column bleed and baseline drift gradually increase. With dual columns, this packing remains useful to at least 290° C.; rapid degradation of the stationary phase begins about 375° C. A variety of compound classes can be separated on this packing, including hydrocarbons, alcohols, aldehydes, and esters over the temperature range indicated.

- 3182 • Treatment of Soybean Oil Soapstock to Reduce Pollution
R. E. Beal, V. E. Sohns, and H. Menge¹
(¹Animal Sci. Res. Div., ARS, USDA, Beltsville, Md.)
J. Amer. Oil Chem. Soc. 49(8): 447-450. August 1972

Often soapstock is acidulated to convert this byproduct of vegetable oil refining to a salable commodity. The acidic waste water from this treatment constitutes a significant part of the environmental pollution from refineries. A process of neutralizing and drying was investigated as a nonpolluting method for upgrading soybean oil soapstock. Neutralization with sulfuric acid was conducted in a ribbon blender. The neutral soapstock was dried to about 4% moisture, either batchwise in a natural circulation evaporator or continuously in a scraped film evaporator. The product is liquid while hot but solidifies to a waxy solid when cooled to room temperature. When added to a standard broiler ration, the feed efficiency and rate of gain of chickens equaled that obtained with a commercial feed fat added at the same level. The soapstock products fed, which contained 200-300 p.p.m. xanthophyll, gave significantly better shank pigmentation than the commercial fat, which contained 3 p.p.m.

- 3183 • Reactions of Carbon Monoxide with Unsaturated Fatty Acids and Derivatives: A Review
E. H. Pryde, E. N. Frankel, and J. C. Cowan
J. Amer. Oil Chem. Soc. 49(8): 451-456. August 1972

The important reactions of carbon monoxide with unsaturated fatty derivatives that are reviewed in this paper include hydroformylation (the oxo reaction), Koch carboxylation, and Reppe carbonylation. With oleic acid as a substrate, the products are C_{19} bifunctional compounds; e.g., formyl- or

carboxystearic acid. Double bond isomerization before carbon monoxide addition is characteristic of these catalytic reactions; additionally, rearrangement to introduce methyl branching occurs in the Koch carboxylation. Isomerization does not occur when a rhodium-triphenylphosphine catalyst replaces cobalt in the oxo reaction. Properties of the C₁₉ dicarboxylic acids differ and depend upon method of preparation. Many areas of application have been reported for C₁₉ compounds--lubricants, plasticizers, polyurethanes, epoxy resins, leather and other coatings, unsaturated polyester resins, and transparent polyamide plastics.

- 3184 • Amino Acid Analysis of Soybean Meal: Interlaboratory Study
J. F. Cavins, W. F. Kwolek,¹ G. E. Inglett, and J. C. Cowan
(¹USDA Biometrical Services, Peoria, Ill.)
J. Ass. Off. Anal. Chem. 55(4): 686-691. July 1972

Amino acid analysis of soybean meal was studied by five laboratories. Between- and within-laboratory variations were significant for most amino acids, whereas variations due to hydrolysis procedure and sample mesh size in the under 30 to under 270 mesh range were significant at the 0.05 level for only two amino acids. The relative standard deviation was different for each amino acid with cystine, methionine, and ammonia having the highest values. Normalization of results to 95% nitrogen recovery had only a small effect on statistical analysis of the data. Values from special analytical procedures for cystine did not agree, whereas those for tryptophan agreed very well.

- 3185 • Aflatoxins M₁ and M₂ and Parasiticol: Thin Layer Chromatography and Physical and Chemical Properties
R. D. Stubblefield, O. L. Shotwell, and G. M. Shannon
J. Ass. Off. Anal. Chem. 55(4): 762-767. July 1972

A survey of known aflatoxin solvent systems for resolution of aflatoxins M₁ and M₂ on thin-layer chromatography (TLC) plates revealed that the best system for determining aflatoxins B₁, B₂, G₁, G₂, M₁, and M₂ is *isopropyl* alcohol:acetone:chloroform (5:10:85, v/v/v). Substitution of various alcohols for *isopropyl* alcohol in this system demonstrated that maximum resolution of M₁ and M₂ was achieved with *n*-amyl alcohol:acetone:chloroform (10:10:80, v/v/v); however, B₁, B₂, G₁, and G₂ migrated with the solvent front. When alcohol:chloroform (5:95, v/v) mixtures were investigated, *n*-propyl, *n*-butyl, and *tert*-butyl alcohol:chloroform resolved M₁ and M₂ best but did not separate B₁, B₂, G₁, or G₂. Molar absorptivities of both M₁ and M₂ were determined in methanol, chloroform, acetonitrile, and acetonitrile:benzene (2:98, v/v). Relative fluorescent intensities of aflatoxins B₁, M₁, and M₂ were compared on both developed and undeveloped TLC plates. Fluorescent intensities of B₁ and M₁ on silica gel were nearly equal, and the intensity of M₂ was 1.4 to 1.5 times that of the other two aflatoxins. Water adducts of aflatoxin M₁ and

parasiticol were prepared. The diacetate adducts of parasiticol were formed by treatment with acetic anhydride and concentrated hydrochloric acid. Monoacetyl derivatives of M_1 , M_2 , and parasiticol were obtained by treatment with pyridine and acetic anhydride. Good resolution of the water-addition derivatives of B_1 , G_1 , parasiticol, and M_1 on TLC plates was achieved with isopropyl alcohol:acetone:chloroform (5:10:85, v/v/v).

3186 • Collaborative Study of the Determination of Aflatoxin in Corn and Soybeans

O. L. Shotwell and R. D. Stubblefield

J. Ass. Off. Anal. Chem. 55(4): 781-788. July 1972

A study was made to determine whether the procedure commonly designated as the CB method, previously recommended by the Association of Official Analytical Chemists for determining aflatoxin in peanuts and peanut products, could be applied to corn and soybeans. Both naturally contaminated and spiked corn and soybeans were extracted and analyzed by thin-layer chromatography (TLC). Of the 15 collaborating laboratories, 9 were equipped to measure aflatoxins on TLC plates densitometrically, as well as visually. Seven collaborators used molar absorptivities to determine the concentration of aflatoxins in solutions to be used for TLC standards. The official CB method has been extended to include corn and soybeans, and the rapid TLC screening technique for aflatoxin in corn has been adopted as official first action.

3187 • Milky Disease Development in Field-Infected Japanese Beetle Larvae

Grant St. Julian, Lee A. Bulla, Jr., and Gordon L. Adams

J. Invertebr. Pathol. 20(1): 109-113. July 1972

By correlated visual and microscopical examination, milky disease of field-infected, third-instar Japanese beetle larvae is categorized into four phases. The phases are described as sequential disease symptoms I through IV. All four phases persist simultaneously throughout experimental incubation. Larvae die during all phases of the disease; however, the largest percentage of death is at phase II and III of the infectious process. At phase II, 90% of the total population of cell types in the infected hemolymph are vegetative cells; in phase III, 65-76% are vegetative cells with 17-28% spores. The massive spore population (95% of population) that characterizes milky disease is designated phase IV; less than 30% of larvae reach this phase of the disease.

- 3188 • Potential Production and Detoxification of Penicillic Acid in Mold-Fermented Sausage (Salami)
 A. Ciegler, H.-J. Mintzlaff,¹ D. Weisleder, and L. Leistner¹
 (¹Institut für Bakteriologie und Histologie, Bundesanstalt für Fleischforschung, Kulmbach, Germany)
 Appl. Microbiol. 24(1): 114-119. July 1972

About 10% of 346 *Penicillium* cultures isolated from mold-fermented sausage synthesized the toxic metabolite penicillic acid on liquid media. Five of these producing cultures inoculated onto sausage failed to produce this toxin in up to 70 days of ripening. Several amino acids normally occurring in meat (cysteine, glutathione, arginine, histidine, and lysine) were found capable of readily reacting with penicillic acid. The adducts formed by the reaction between cysteine or glutathione with penicillic acid were identified and found to be nontoxic to mice, quails, and in the rabbit skin test but exhibited toxicity to the chick embryo. Hypotheses accounting for this residual toxicity are advanced.

- 3189 • Rubber Reinforcement by Starch Poly(ethylenimino Thiourethane)
 J. A. Douglas, G. G. Maher, C. R. Russell, and C. E. Rist
 J. Appl. Polym. Sci. 16(8): 1937-1946. August 1972

Starch xanthates with degrees of substitution (D.S.) ranging from 0.08 to 0.58 were reacted with high or low molecular weight polyethylenimine (PEI, two of six times the stoichiometric amount) to form starch poly(ethylenimino thiourethanes). Aqueous thiourethane solutions were mixed with commercial styrene-butadiene and acrylonitrile-butadiene latices, and the solids were coprecipitated by adding 1M ZnSO₄ and 1N H₂SO₄. The master batches (filtered, dried at 70° C.), having 15 to 50 parts of starch (equivalent) per 100 parts of rubber (phr), were masticated and compounded in a sulfur-accelerator recipe and press cured to yield vulcanizates of improved physical characteristics compared to control vulcanizates. About 0.22 D.S. produced best results. With this D.S. xanthate and a 3.5 ratio of 100,000 MW PEI, a 25 phr starch loading gave maximum tensile strength (2,720 psi) in a styrene-butadiene vulcanizate. Hardness generally increased with increasing D.S. and starch contents. The thiourethane decreased compression set and increased abrasion resistance. The former was lowest and the latter highest at about 0.20 D.S. and 25 phr starch. Both set and abrasion were lowest with thiourethane prepared from xanthate made in a "Roto-feed" process rather than a "Ko-Kneader" operation. Rebound was not appreciably changed, and increase of volume swelling in water was small upon thiourethane incorporation.

3190 • Extracellular Mannans from Yeasts

M. E. Slodki, R. M. Ward, and M. C. Cadmus
 Develop. Ind. Microbiol. 13: 428-435. 1972

Yeasts previously reported to produce extracellular phosphomannans alternatively synthesize neutral mannans when orthophosphate is omitted from the growth medium. Strains capable of synthesizing phosphomannan excrete mannan in similarly high yield; i.e., up to 70% conversion of glucose. Mannans from *Hansenula holstii* NRRL Y-2448, *Hansenula capsulata* NRRL Y-1842, and *Pichia mucosa* NRRL YB-1344 are investigated in greater detail. All three polymers are structurally different as judged by optical rotation, periodate oxidation, Smith degradation, and interaction with concanavalin A. These criteria also indicate that the mannans of *H. holstii* and *H. capsulata* differ from mannan-like portions of phosphomannans produced by the same yeasts. *P. mucosa* differs from the other yeasts in that only a mannan is produced.

3191 • Fate of EDC-CCl₄ (75:25) Residues During Milling and Oil Extraction of Soybeans

Charles L. Storey,¹ Larry D. Kirk, and Gus C. Mustakas
 (¹Mid-West Grain Insects Investigations, Market Quality
 Res. Div., ARS, Manhattan, Kansas)
 J. Econ. Entomol. 65(4): 1126-1129. August 1972

When soybeans were fumigated with ethylene dichloride-carbon tetrachloride (75:25, EDC-CCl₄), a residue of each component of this mixture remained in both the hull and interior portion of the treated soybeans. Residues found in the various milling and processing fractions of the fumigated soybeans indicated that toasting removed the residues from the hulls but that steaming involved in the flaking process did not remove residues from dehulled soybeans. Fumigant residues from the flakes passed into both the miscella and extracted marc and were subsequently detected in the recovered hexane from both of these fractions. The solvent-free oil and meal products contained no residues. Accumulations of residues in the recovered hexane could present a contamination problem to the soybean processor as he depends upon the continuous reuse of hexane in his oil extraction process.

3192 • Maize with Multilayer Aleurone of High Protein Content

M. J. Wolf, H. C. Cutler,¹ M. S. Zuber,² and Uheng Khoo
 (¹Missouri Botanical Garden, St. Louis; ²University of
 Missouri, Columbia)
 Crop Sci. 12(4): 440-442. July-August 1972

Coroico corn (*Zea mays* L.), a South American race of floury maize, contained two to six layers of aleurone cells instead of the customary single aleurone cell layer found in ordinary yellow dent corn. In Coroico with an average of 3.7 aleurone cell layers, the aleurone made up 4.3% of the

endosperm as against 2.1% in yellow dent corn. Total protein in Coroico aleurone is 35 to 38% compared with 22% in yellow dent corn. Lysine levels in aleurone proteins of all corns examined, both Coroico and yellow dent were comparable ranging from 4.0 to 4.4 g./100 g. of protein. Because of the additive effect of the multiple aleurone and the high protein content of the aleurone, lysine in Coroico endosperm was higher than in that of yellow dent corn. Multiple aleurone is transmitted as a partial dominant character over the normal single aleurone condition. Improvement of protein nutritional quality using Coroico germ plasm appears worthwhile.

- 3193 • Publications and Patents of the Northern Marketing and Nutrition Research Division, January-June 1972
North. Market. Nutr. Res. Div.
U.S. Agr. Res. Serv., Unnumb. Pub., 68 pp. [August 1972]
- 3194 • Pretreatments of Kenaf to Produce Quality Pulps
M. O. Bagby, T. F. Clark, R. L. Cunningham, and
W. H. Tallent
In "Non-Wood Plant Fiber Pulping Progress Report No. 3,"
TAPPI CA Report No. 43, pp. 5-24. 1972

Green kenaf was dejuiced in either commercial screw or roll presses to remove much of the water-soluble components and to provide an enriched cellulosic raw material. Selected dejuiced kenaf and field-dried kenaf were scoured and screened to further enrich the cellulose content by removal of additional solubles and fine cellular materials. Contrasted with untreated kenaf, advantages realized by such treatment are economy in chemical requirements for pulping and bleaching and faster draining pulps.

Not only do the treated green and field-dried kenaf have similar properties, but pulps from them also exhibit similar properties. This similarity offers assurance that a uniform raw material from kenaf, regardless of harvesting schedule, can be charged to a digester and that pulps of consistent quality will result.

- 3195 • Characteristics of Sulfate Pulps from Kenaf Bark and Core
 G. F. Touzinsky, T. F. Clark, and W. H. Tallent
In "Non-Wood Plant Fiber Pulping Progress Report No. 3,"
 TAPPI CA Report No. 43, pp. 25-54. 1972

Separate sulfate pulps were prepared from the bark and woody components of kenaf as the first phase of a program to identify and assess factors affecting hydration and drainage. Under identical cooking conditions, bark cooked more readily than core and gave a strong, free pulp. Microscopic examination showed that the bark pulp consisted almost entirely of long fibers, whereas the woody core pulp contained short fibers and a large number of nonfibrous cells. Evaluation of the pulps with two refiners (Valley beater and PFI mill) revealed that the woody core pulp beat rapidly and was the cause of the rapid reduction in freeness of kenaf whole pulp. Physical properties of blends of bark and core pulps correlated well with those of whole kenaf and those calculated from the separate pulps.

- 3196 • Composition of Air-Classified Defatted Corn and Wheat-Germ Flours
 W. J. Garcia, H. W. Gardner, J. F. Cavins, A. C. Stringfellow, C. W. Blessin, and G. E. Inglett
 Cereal Chem. 49(5): 499-507. September-October 1972

Commercial corn and wheat germ were each separated into five fractions by air classification. Compositional data show that mineral, carbohydrate, and amino acid concentrations vary among the five fractions from each germ. In both separations mineral enhancement occurs in the first two air-classified fractions. Mineral data are given for phosphorus, potassium, magnesium, calcium, sodium, iron, copper, and zinc. Conversely, an enhancement of carbohydrate occurs in air-classified fractions 3, 4, and 5. The major shift in carbohydrate content is due primarily to starch and secondarily to pentosans. Carbohydrate differences between wheat and corn germ are due mainly to a higher sugar content in wheat germ. Protein quality for both types is essentially equivalent, although corn germ contains less protein. Amino acid composition of the fractions from each germ is similar; significant minor variations occur in the first and fifth air-classified fractions.

- 3197 • Lipxygenase and Peroxidase Activities of Soybeans as Related to the Flavor Profile During Maturation
 J. J. Rackis, D. H. Honig, D. J. Sessa, and Helen A. Moser
 Cereal Chem. 49(5): 586-597. September-October 1972

Hawkeye and Amsoy soybeans were picked at 15 intervals from 24 to about 66 days after flowering. During maturation, percentage of dry matter

increased from 16 to 92 and total dry matter from 5 to 243 mg. per bean. Flavor intensities of each picking were determined by a taste panel. Lipoxygenase activity of beans of similar fresh weight, picked on the same day, was measured by the oxygen uptake method. Beany and bitter were the two predominant flavors in maturing soybeans. Most tasters used the terms green-beany, beany, and raw beany to describe the "bean-iness" of soybeans. Grassy was an infrequent response. Beany and bitter flavor responses were recorded as flavor intensity values (FIV) based on a scale of 1 for weak, 2 for moderate, and 3 for strong. FIV with respect to beany varied from 2.0 to 2.7 during maturation, with the average being 2.4; no significant trends were noted. The average FIV for bitter for the two varieties increased threefold from about 0.54 in immature soybeans to 1.9 at maturity.

Lipoxygenase activity at pH 6.8 varied from a low of 12 μ liters O_2 per min. per mg. dry matter in the early stages to 35 at 34 days after flowering, then down to 23 at 45 days, up to 43 at about 1 week before maturity, and then slowly decreased to about 32 μ liters O_2 uptake at maturity; O_2 uptake values of 11 to 23 μ liters were recorded for lipoxygenase activity at pH 9.0. The FIV for beany did not correlate with changes in lipoxygenase activity; however, a correlation ($r = 0.73$) exists between lipoxygenase activity and the increase in FIV for bitter flavor as beans mature. An active peroxidase capable of utilizing linolenic hydroperoxide was also present. Peroxidase activity remained relatively constant throughout most of the maturation period, except for a large decrease at maturity.

3198 • Infusion of Grain Sorghum with Lysine, Methionine, and Tryptophan

J. F. Cavins, C. W. Blessin, and G. E. Inglett

Cereal Chem. 49(5): 605-608. September-October 1972

Amino acid balance in grain sorghum was altered significantly by infusion of lysine, methionine, and tryptophan. Infusion is affected by such factors as time, temperature, and concentration of infusion solution. Infusion proceeds in two stages, one being concentration-dependent and the other concentration-independent. Amino acid solubility affects the maximum level of infusion possible. A wide range of amino acid levels can be obtained in the product by varying infusion conditions. The desired level of amino acid can be achieved by either infusion of the total lot, or infusion of a small batch to a high concentration followed by blending with noninfused grain.

- 3199 • Synthesis of Acetoxydihydromaltol Acetate and Dihydromaltol
Frank D. Mills
Carbohydr. Res. 23(3): 433-436. August 1972

Successful hydrogenation of maltol acetate with a palladium-on-carbon catalyst yields dihydromaltol acetate (57%); subsequent hydrolysis or α -acetoxylation produces dihydrol maltol (52%) and α -acetoxydihydromaltol acetate (16%). Each product has been characterized by mass spectral, magnetic resonance, and infrared analyses.

- 3200 • Starch Polyethylenimino Thiourethane: A Wet- and Dry-Strength Agent
G. G. Maher, A. J. Ernst, H. D. Heath, B. T. Hofreiter, and C. E. Rist
Tappi 55(9): 1378-1384. September 1972

Starch polyethylenimino thiourethane, prepared in aqueous solution from starch xanthate and polyethylenimine, was evaluated as a wet-end additive in handsheet and machine-made paper. The effects of several variables in the thiourethane synthesis and in the papermaking processes were investigated. Also, a study was made of the thiourethane solids, isolated in several ways from the original aqueous solution and then reconstituted in water. This starch derivative increased burst strength, folding endurance, dry breaking length, and wet breaking length--the last most notably.

- 3201 • L-Dopa Recovery from *Mucuna* Seed
Melvin E. Daxenbichler, Cecil H. VanEtten, Fontaine R. Earle, and William H. Tallent
J. Agr. Food Chem. 20(5): 1046-1048. September-October 1972

A simple hot water extraction and ion exchange procedure gave excellent recoveries of L-dopa from seed of nine species of *Mucuna*. Use of a modified dextran column as an additional step permitted recovery of nearly all the L-dopa present in the seed. Yields from eight species examined ranged from 3.1 to 6.1% of the mature seed.

- 3202 • Antitumor Alkaloids from *Cephalotaxus harringtonia*: Structure and Activity
R. G. Powell, D. Weisleder, and C. R. Smith, Jr.
J. Pharm. Sci. 61(8): 1227-1230. August 1972

Cephalotaxine and several of its esters were isolated from *Cephalotaxus harringtonia* K. Koch var. *harringtonia*. Although cephalotaxine is inactive, harringtonine, isoharringtonine, homoharringtonine, and deoxy-harringtonine have shown significant activity against experimental P388 leukemia and against L-1210 leukemia in mice.

- 3203 • Control of *Penicillium martensii* Development and Penicillic Acid Production by Atmospheric Gases and Temperatures
E. B. Lillehoj, M. S. Milburn, and A. Ciegler
Appl. Microbiol. 24(2): 198-201. August 1972

The effects of various gaseous environments and temperatures on development of *Penicillium martensii* NRRL 3612 and production of penicillic acid (PA) were determined. Accumulation of PA in mold-inoculated corn was measured following incubation under air; 20% CO₂, 20% O₂, 60% N₂; 40% CO₂, 20% O₂, 40% N₂; and 60% CO₂, 20% O₂, 20% N₂. Although reduced temperature initially inhibited PA production, at the end of the trial the largest quantity of PA (120 µg./g. of corn) was found in air-incubated corn at the lowest test temperature (5° C.). Atmospheres enriched with 60% CO₂ reduced PA accumulation below a detectable level at 5° and 10° C. after a 4-week incubation period. Spore germination tests were carried out in a liquid growth medium incubated for 16 hours under several test conditions. Germ tube outgrowth at 30° C. ranged from 36% in air to 2% in 60% CO₂, whereas no germination was observed in CO₂-enriched gases at 10° C. When spore respiration rates were measured in air and O₂ in a liquid growth medium, complete removal of CO₂ from the reaction atmosphere did not reduce O₂ uptake.

- 3204 • Analytical Problems in Agricultural Science
G. W. Irving, Jr. and W. C. Schaefer
Nat. Bur. Stand. (U.S.) Spec. Publ. 351, chap. 4,
pp. 161-231. August 1972

This paper presents a review and analysis of the widespread applications of analytical chemistry and analytical instrumentation in the research and regulatory programs of the U.S. Department of Agriculture's Agricultural Research Service. Analytical chemistry is one of the essential sciences needed in advancing the commodity and people-oriented programs which can achieve the national goals of the Department. Chemical analysis will be shown to play a vital role in assuring an adequate supply of farm and forest products and in assuring the consumer a better product while minimizing costs for processing and distribution. In people-oriented programs, such as consumer health, safety and pollution abatement, analytical methodology is the key procedure for providing the basic data to get action programs into motion.

Few agricultural scientists will admit complete satisfaction with any of their current methodologies. Yet some problems are more important than others. An assessment of these problems is made including an analysis of their relative importance in conjunction with the urgent needs of agriculture. Other problems are discussed for which there appears no current solution. This will challenge the ingenuity and creativity of analytical chemists in the future.

3205 • Severe Oral Lesions in Chickens Caused by Ingestion of Dietary Fusariotoxin T-2

R. D. Wyatt,¹ B. A. Weeks,¹ P. B. Hamilton,¹ and H. R. Burmeister

(¹North Carolina State University, Raleigh)

Appl. Microbiol. 24(2): 251-257. August 1972

Fusariotoxin T-2 is a mycotoxin produced by *Fusarium tricinctum* which was implicated in moldy corn toxicosis of farm animals. Graded concentrations of dietary fusariotoxin T-2 (0, 1, 2, 4, 8, and 16 $\mu\text{g./g.}$, respectively) were given to groups of 40 chickens. Raised yellowish-white lesions on the mouth parts were produced by all concentrations, and the size of the lesions was dose-related. The growth rate was reduced significantly ($P < 0.05$) by concentrations of 4, 8, and 16 $\mu\text{g./g.}$ The mouth fluid of the affected birds contained greatly increased numbers of bacteria, including *Staphylococcus epidermidis* and *Escherichia coli*, which proved avirulent when inoculated into scarified tissue of control birds. Microscopy examinations of the lesions revealed a fibrinous surface layer, intermediate layers containing invaginations filled with rods and cocci, and a heavy infiltration of the underlying tissues with granular leukocytes. These data suggest that the role of fusariotoxin T-2 in field cases of moldy corn toxicosis should be reinvestigated since oral lesions were not mentioned in the original descriptions of the disease. However, the lesions bear some features of those characteristic of the third or septic angina stage of alimentary toxic aleukia, a nutritional toxicosis of humans produced by eating grains infested with *F. tricinctum*.

3206 • Continuous Conversion of Modified Starch to Glucose by Immobilized Glucoamylase

K. L. Smiley

Proc. Int. Symp. Conversion and Manufacture of Food by Microorganisms, Kyoto, Japan, December 6-8, 1971, pp. 79-86. 1972

Partially purified commercial glucoamylase was immobilized both on aryl-amino porous glass beads either by reaction with glutaraldehyde or by diazotization and on diethylaminoethyl cellulose in the presence of low ionic-strength acetate buffers at pH 4.2. In stirred reactors, these bound enzymes converted modified starch substrates continuously to glucose. Concentrations of α -amylase-converted starch as high as 30% could be quantitatively converted to glucose. The half-life of the enzyme-glass complex prepared by crosslinking with glutaraldehyde was 60 days. Loss in activity occurs because the glass dissolves and not because the enzyme becomes inactive. Cellulose-glucoamylase complex also lost activity with time as the cellulose became coated with insoluble starch degradation products. Glucose production per unit of enzyme is at least 10 times greater with bound enzyme than with soluble enzyme. Glucoamylase-glass prepared by diazotization appeared to be superior to glucoamylase-glass prepared by glutaraldehyde reaction.

3207 • Some New Approaches in Lipid Research

Herbert J. Dutton

Chem. Ind. (London) (17): 665-672. September 1972

The pattern of glyceride structure remains a challenging and unsolved problem of lipid chemistry, differential migration, selective enzymatic, mass spectrometric, and other advanced techniques notwithstanding. Partially hydrogenated fats present an even more complicated system to analyze for which a variety of techniques are being deployed including microreactors, chromatography in its many forms, stable and radioactive isotopes, spectrometry and digital computers in batch and real time mode. Composition of the hardened fats we consume in our diets reflects, in part, the kinetics of heterogeneous catalysis and relates to "human health and welfare."

This paper was delivered as the Third Hilditch Memorial Lecture at Liverpool, England, on November 4, 1971.

3208 • Alkali Isomerization of Linoleate Isomers: Characterization of Products

Sambasivarao Koritala

J. Amer. Oil Chem. Soc. 49(9): 534-536. September 1972

Geometrical isomers of methyl linoleate were reacted with alkali, and the resulting conjugated isomers were separated into *trans,trans*; *cis,trans*; and *cis,cis* fractions. The position of double bonds in the various fractions was determined by reductive ozonolysis. *trans*-9,*trans*-12-Isomer of linoleate formed *trans,trans*- and *cis,trans*-conjugated dienes, whereas *cis*-9,*trans*-12- and *trans*-9,*cis*-12-isomers in addition formed *cis,cis*-conjugated dienes. Formation of these products is in accordance with theoretical predictions. During conjugation *trans* double bonds shifted to form a *trans* bond preferentially. During conjugation of *cis*-9,*trans*-12- and *trans*-9,*cis*-12-linoleate isomers, the *cis* double bond shifted preferentially over the *trans* double bond. A small amount of diene not conjugated was probably a geometrical and positional isomer of the starting material.

3209 • Potential Lubricants for Continuous Casting of Steel: Polyol Esters of Partially Hydrogenated Soybean Acids

E. W. Bell, J. C. Cowan, and L. E. Gast

J. Amer. Oil Chem. Soc. 49(10): 552-554. October 1972

In the past decade continuous casting of steel into billets and slabs without going through the ingot stage has drawn widespread attention in the steel industry. Mold lubrication is vital to continuous casting to prevent sticking. Approximately 50% of this operation uses a vegetable oil lubricant, primarily rapeseed oil. Trimethylolethane, trimethylolpropane,

trimethylolbutane, and pentaerythritol esters of partially hydrogenated soybean fatty acids, derived from commercially hydrogenated soybean oils, have been readily prepared in good yields. Preliminary measurements of viscosities, smoke, flash, and fire points of these polyol esters indicate that they are possible candidates for use as lubricants in the continuous casting of steel.

3210 • Room Odor Evaluation of Oils and Cooking Fats

C. D. Evans, Kathleen Warner, G. R. List, and J. C. Cowan
J. Amer. Oil Chem. Soc. 49(10): 578-582. October 1972

Panel evaluations have been made of room odors developed by edible oils and cooking fats heated to frying temperatures. Vegetable and mixed fat shortenings, as well as oils of different iodine value and from special processing, were investigated with and without added stabilizers. When silicones were added to frying fats, room odor scores improved markedly. Certain added autoxidative cleavage products had little effect on odor scores at levels where they were detected easily in taste tests. To be discernible in room odors, these additives had to be present at levels about 100-fold greater than their taste thresholds. Panel results show that the undesirable frying odors contributed by unhydrogenated soybean oil in mixtures with other oils could be detected readily at 25% levels. As the level of soybean oil was lowered further, the room odor scores of oil mixtures improved perceptibly.

3211 • Hydrogenation of *cis*-9,*cis*-12-, *cis*-9,*trans*-12- and *trans*-9,*trans*-12-Octadecadienoates

C. R. Scholfield
J. Amer. Oil Chem. Soc. 49(10): 583-585. October 1972

The products formed by hydrogenation of methyl *cis*-9,*trans*-12- and *trans*-9,*trans*-12-octadecadienoates with nickel and platinum catalysts have been compared with those from methyl esters of the naturally occurring all-*cis* linoleate. Hydrogen uptake is slower for the *trans* isomers. Much of the monoene consisted of esters with double bonds at the 9 and 12 positions with their original geometric configurations. Monoenoic esters with double bonds at the 10 and 11 positions were predominantly *trans* and apparently formed by conjugation before hydrogenation. Nickel produced more isomerization than platinum but less than previously reported for copper. With both catalysts hydrogenation proceeded both directly and through conjugated intermediates, in contrast to a copper catalyst that apparently causes all hydrogenation to follow conjugation.

- 3212 • Diene-to-Saturate Shunt in Fat Hydrogenation
C. R. Scholfield, R. O. Butterfield, and H. J. Dutton
J. Amer. Oil Chem. Soc. 49(10): 586-589. October 1972

In matching experimental data to kinetic models for hydrogenation of methyl *cis*-9,*cis*-15-linoleate, ethylene glycol diundecylenate and 1,7-octadiene with platinum or palladium catalysts, only if a diene-to-saturate shunt of 15- to 25% is included can a good fit be secured between the model and experimental composition. With nickel the shunt is much smaller or absent. Although the shunt might be attributed most readily to a liquid diffusion effect, its independence of temperature, viscosity, and presence or absence of solvents and catalyst support suggests that some other factor is responsible. Evidence for similar shunts is found for other materials, including soybean triglycerides.

- 3213 • Laundry Soil-Suspending Activity of Certain Microbial Polysaccharides
A. Jeanes, R. G. Bistline,¹ and A. J. Stirton¹
(¹Eastern Regional Research Laboratory, Philadelphia, Pa.)
J. Amer. Oil Chem. Soc. 49(10): 610-612. October 1972

Certain extracellular microbial anionic heteropolysaccharides and phosphorylated mannans suspend laundry soil comparably with carboxymethyl cellulose. These biodegradable biopolymers have other properties compatible with components commonly used in detergent formulations.

- 3214* • Aliphatic Dibasic Acids
E. H. Pryde and J. C. Cowan
In "Condensation Monomers," vol. 27 of High Polymers,
ed. J. K. Stille, pp. 1-153. Somerset, New Jersey. 1972

Aliphatic dibasic acids include straight-chain, branched, saturated, unsaturated, and, for the purposes of this chapter, alicyclic dicarboxylic acids. Of these, the most important commercially are the α -, ω -alkanedioic acids, especially adipic acid. Their importance arises chiefly from their bifunctionality, which permits them to undergo various polycondensation reactions for the preparation of certain polymers and plastics. Several of the most accessible acids along with pertinent references are listed in Table 1, and the most important of these are discussed in individual sections as indicated. The unsaturated dicarboxylic acids listed have been reviewed adequately elsewhere and, of the cyclic acids listed, only dimer acid is discussed here. The remaining cyclic acids were mentioned because of interest in them as monomers and their potential availability.

The alkanedioic acids constitute an interesting homologous series; yet major differences in their properties point out the fallacy of considering them to have complete uniformity. Carbonic acid is listed as the initial member of the homologous alkanedioic acids, being a dibasic although not a

dicarboxylic acid. It is, of course, not usable in the free acid form because of its instability. However, it is available as a monomer in the form of the acid chloride (phosgene), the ester chloride (chloroformate), and the amide (urea).

3215 • Decomposition of Dithiobis(thioformates) with *p*-Chlorobenzenethiol

B. S. Shasha, E. I. Stout, W. M. Doane, and C. R. Russell
Carbohydr. Res. 24(1): 115-121. September 1972

A simple and fast procedure is described for the decomposition of

dithiobis(thioformates) $[\text{ROC}(\text{S})_2\text{SCOR}]$ by reaction with two equivalents of *p*-chlorobenzenethiol in pyridine for 10 minutes at 25° C. The procedure is effective even with derivatized starch, which is insoluble under the reaction conditions. With less than two equivalents, the intermediate mixed disulfide is obtained. Other functional groups that react with this reagent are $\text{ROC}(\text{S})_2\text{SSSCOR}$, $\text{ROC}(\text{S})_2\text{SOMe}$, $\text{ROC}(\text{S})_2\text{SCOR}$, $\text{ROC}(\text{S})_2\text{SP}(\text{OMe})_2$, and $\text{ROC}(\text{S})_2\text{SC}_6\text{H}_4(\text{NO}_2)_2$. However, functional groups $\text{ROC}(\text{S})_2\text{COR}$, $\text{ROC}(\text{S})_2\text{SCH}_2\text{Ar}$, $\text{ROC}(\text{S})_2\text{SMe}$, $\text{ROC}(\text{S})_2\text{CSR}$, RSCSR , $\text{ROC}(\text{S})_2\text{NET}_2$, $\text{ROC}(\text{S})_2\text{COR}$, and $\text{ROSO}_2\text{C}_6\text{H}_4\text{Me}$ do not react (R = carbohydrate moiety).

3216 • Microbial Population of Feedlot Waste and Associated Sites

R. A. Rhodes and G. R. Hrubant
Appl. Microbiol. 24(3): 369-377. September 1972

A quantitative determination was made every 2 months for a year of the microflora of beef cattle waste and runoff at a medium-sized midwestern feedlot. Counts were obtained for selected groups of organisms in waste taken from paved areas of pens cleaned daily and, therefore, reflect the flora of raw waste. Overall, in terms of viable count per gram dry weight, the feedlot waste contained 10^{10} total organisms, 10^9 anaerobes, 10^8 Gram-negative bacteria, 10^7 coliforms, 10^6 sporeformers, and 10^5 yeasts, fungi, and streptomycetes. The specific numbers and pattern of these groups of organisms varied only slightly during the study in spite of a wide variation in weather. Data indicate that little microbial growth occurs in the waste as it exists in the feedlot. Runoff from the pens contained the same general population pattern but with greater variation attributable to volume of liquid. Comparable determinations of an associated field disposal area (before and after cropping), stockpiled waste, and elevated dirt areas in the pens indicate that fungi, and especially streptomycetes, are the aerobic organisms most associated with final stabilization of the waste. Yeasts, which are the dominant type of organism in the ensiled corn fed the cattle, do not occur in large numbers in the animal waste. Large ditches receiving runoff and subsurface water from the fields have a population similar to the runoff but with fewer coliforms.

3217 • Enterobacteria in Feedlot Waste and Runoff

G. R. Hrubant, R. V. Daugherty, and R. A. Rhodes
 Appl. Microbiol. 24(3): 378-383. September 1972

Samples of beef cattle feedlot waste (FLW), runoff from the pens, and water from a large drainage ditch at the feedlot were examined for *Enterobacteriaceae*. The drainage ditch receives the runoff but contains primarily subsurface drainage from fields on which FLW is spread for disposal. Plating and enrichment techniques with seven different media were used to isolate 553 cultures of enterobacteria. FLW contains about 50 million enterobacteria per gram dry weight. More than 90% of these were *Escherichia coli*, none of which were enteropathogenic types as determined with multivalent sera. *Citrobacter* and *Enterobacter cloacae* were other organisms present in moderate numbers. Application of enrichment techniques broadened the spectrum of enterobacteria isolates to include the four *Proteus* spp., both *Providencia* spp., *Klebsiella*, *Enterobacter aerogenes*, *Arizona*, and a single isolate of *Salmonella* (serological group C₂). *Shigella* was not isolated. The wide spectrum of enterobacteria in FLW may be a hazard if unsterilized waste is refed. Fewer enterobacteria occurred in the runoff and in the drainage ditch; the most numerous species in FLW also were most numerous at these sites. However, neither *Salmonella* nor *Arizona* was isolated from runoff or drainage-ditch waters.

3218* • Explanation of Ionic Sequences in Various Phenomena.
 VIII. The Structure of Aqueous Urea and DMSO and
 Their Mechanism as Dispersing Agents

Stig R. Erlander¹ and R. Tobin

(¹Ambassador College, Pasadena, Calif.)

J. Macromol. Sci.-Chem. A2(8): 1521-1542. December 1968

Many recent experiments have shown that urea behaves as a zwitterion. By measuring the solubility of urea in various aqueous salt solutions and by obtaining the effect of salts on the dispersing power of urea, the structure of urea and its mechanism for destroying hydrogen and hydrophobic bonds were elucidated. The zwitterion structure of urea was confirmed by means of these ionic sequence studies. The K⁺ ion increases the dispersion power of urea and decreases its solubility more than any of the other monovalent cations because the K⁺ ion forms a more insoluble salt bond with the negatively charged oxygen atom of the urea zwitterion. This salt bond is more insoluble than the urea-urea bond. Hence, more positively charged -NH₂ groups on urea are liberated by the addition of KCl. The dispersion power of the urea molecule is the result of the interaction of the negatively hydrated domain (B regions) surrounding these -NH₂ groups with the oxygen atoms involved in the hydrogen bonds between starch molecules. These B regions on urea -NH₂ groups are more effective in destroying hydrogen bonds than normal water molecules. That is, the anionic sequences and the solubility of benzene in aqueous urea solutions show that the hydrated -NH₂ groups of urea have an effective dielectric constant

that is greater than that of water and is approximately equal to that of the hydrated guanidinium ion. However, the urea-urea salt complexes or polymers lower the effectiveness of urea at high urea concentrations. The charge density of the urea anion is between that of the Cl^- and F^- anions and consequently does not contribute to the dispersing power of urea. By destroying water clusters, the $-\text{NH}_2$ groups of urea increase the domain which hydrocarbons can occupy and hence destroy hydrophobic bonds. The destruction of hydrogen and hydrophobic bonds by urea therefore involves the electrostatic interactions between the urea B regions and the surrounding hydrogen bonds. It is also shown that DMSO behaves as a stronger zwitterion than urea and that it has the properties of a small anionic detergent. Anhydrous DMSO dissolves polar polymers and molecules by complexing its strongly ionized oxygen atom with the polar group. Urea and formamide form aggregates with themselves and therefore are incapable of dispersing polymers in this manner.

- 3219 • Tetra-Acid Triglycerides Containing a New Hydroxy Eicosadienoyl Moiety in *Lesquerella auriculata* Seed Oil
 R. Kleiman, G. F. Spencer, F. R. Earle, H. J. Nieschlag, and A. S. Barclay¹
 (¹Plant Science Research Division, Beltsville, Md.)
 Lipids 7(10): 660-665. October 1972

The seed oil of *Lesquerella auriculata* contains 32% of a previously unknown fatty acid, 14-hydroxy-*cis*-11,*cis*-17-eicosadienoic acid; we propose for it the trivial name "auricollic acid." In addition, the oil contains 2% densipolic (12-hydroxy-*cis*-9,*cis*-15-octadecadienoic) acid, 10% lesquerolic (14-hydroxy-*cis*-11-eicosenoic) acid, and 5% ricinoleic acid. The oil of *L. auriculata* is also unusual, because a large part of the total oil consists of triglycerides containing more than three acyl groups. These components were characterized by various chromatographic, spectroscopic, and lipolytic techniques.

- 3220 • Carbamoyl ethyl Wheat Flour as a Wet- and Dry-Strength Agent for Paper
 H. E. Smith, S. H. Gordon, W. M. Doane, and C. R. Russell
 Staerke 24(9): 299-305. September 1972

Unbleached kraft paper exhibiting a ten- to fifteenfold increase in wet-tensile strength accompanied by substantial increases in burst, dry-tensile strength, and folding endurance was obtained from the use of hypochlorite-treated carbamoyl ethyl wheat flour as a wet-end additive. Results with bleached kraft pulps were less spectacular but still good. Such variables as pH of the carbamoyl ethyl wheat flour (CEWF) paste before hypochlorite treatment, pulp-type and freeness, drying and curing temperature of the treated paper, and the amount of CEWF influence strength properties of paper. A pH of 2 was optimum for treatment of aqueous CEWF pastes with

hypochlorite. Unbleached kraft pulp having a Canadian Standard freeness (CSf) of about 500 milliliters produced paper exhibiting the best overall strength properties. Maximum wet- and dry-tensile strength was imparted to unbleached kraft handsheets dried at 105° C. for 15 minutes. Strength properties increased as level of addition increased from 0.25 to 5%. Addition of CEWF at a 2% level to unbleached kraft furnishes gave handsheets exhibiting wet- and dry-tensile strength as high as 3,340 and 10,510 m, respectively, as compared with corresponding values of 240 and 6,980 m for the control. Hypochlorite-treated CEWF was comparable to carbamoyl ethyl starch in imparting wet-strength properties to unbleached kraft paper.

3221 • Monothiocarbonate Derivatives of 1,2:5,6-Di-*O*-isopropylidene- α -D-glucofuranose

B. S. Shasha, W. M. Doane, and C. R. Russell

Carbohydr. Res. 24(1): 202-206. September 1972

The monothiocarbonate salt (1) of 1,2:5,6-di-*O*-isopropylidene- α -D-glucofuranose was prepared by the reaction of the sugar alcoholate with carbonyl sulfide. Oxidation of 1 with iodine gave the corresponding disulfide (2), which upon selective acid hydrolysis of the 5,6-*O*-isopropylidene group followed by treatment with pyridine gave 1,2-*O*-isopropylidene- α -D-glucofuranose 5,6-carbonate (4). Compound 4 was also obtained by reaction of 1 with methyl iodide to give the corresponding *S*-methyl derivative, followed by selective acid hydrolysis and treatment with triethylamine. Product 2 reacted with triisopropyl phosphite to yield bis(3-*O*-carbonyl-1,2:5,6-di-*O*-isopropylidene- α -D-glucofuranose) monosulfide (6) which on pyrolysis gave bis(1,2:5,6-di-*O*-isopropylidene- α -D-glucofuranos-3-yl) 3,3'-carbonate (5). Product 5 was also obtained by pyrolysis of 2. Triisopropyl phosphite also reacted with the thiocarbonyl analogue of 2 (7) to give the monosulfide analogue (8) which on pyrolysis led to thionocarbonate (9).

3222* • The Alkaloids of Tall Fescue: Loline (Festucine) and Perloline

H. L. Tookey and S. G. Yates

An. Quim. 68(5-6): 921-935. May-June 1972

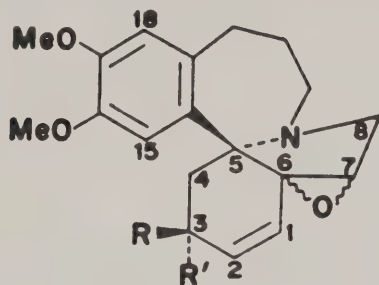
The alkaloids (11 in all) of tall fescue (*Festuca arundinacea* Schreb.) are similar to those of ryegrass (*Lolium perenne* L.). The compounds identified from tall fescue represent two divergent chemical structures; for example, loline and *N*-acetyl loline contain the pyrrolizidine ring, and perloline has a diazaphenanthrine ring. Not one of these alkaloids has been completely synthesized, at least none in the 50 publications reviewed here. The alkaloid content of the grass varies with season of the year and is increased by nitrate fertilization. Loline has low toxicity; an oral dose of 400 mg./kg. has no effect in mice, but this dosage given i.v. is lethal. Perloline usually kills mice at 250 mg./kg. i.p., and produces tetanic spasm in sheep at a dose of 21 mg./kg. i.p. Perloline at 9×10^{-5} M inhibits cellulose digestion in an artificial rumen.

3223 • Alkaloids of *Cephalotaxus wilsoniana*

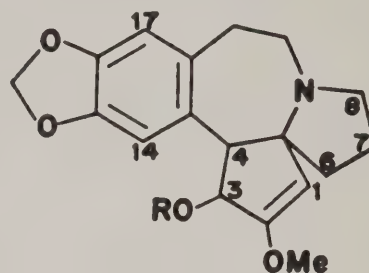
R. G. Powell, K. L. Mikolajczak, D. Weisleder,
and C. R. Smith, Jr.

Phytochemistry 11(11): 3317-3320. November 1972

Four alkaloids have been isolated from extracts of *Cephalotaxus wilsoniana* Hayata. The major alkaloid (I), for which the name wilsonine is proposed, occurs with its C-3 epimer (II); in addition to these homoerythrina alkaloids, minor amounts of cephalotaxine (III) and acetylcephalotaxine (IV) are also found.



(I) R = OMe; R' = H
(II) R = H; R' = OMe



(III) R = H
(IV) R = Ac

3224* • Aflatoxin--What Causes It, How To Identify It, and What To Do With It

R. J. Bothast

Proc. Grain Quality Conf. on Aflatoxin and Air Pollution
Control, Iowa State University, Ames, July 27, 1972,
pp. 9-16. September 1972

Aflatoxin is produced by certain strains of the molds *Aspergillus flavus* and *A. parasiticus*. Procedures to detect aflatoxin fall into three categories:

1. Detection of corn possibly containing aflatoxin.....Fluorescence
2. Identification of aflatoxin in corn.....Millicolumn
3. Determination of aflatoxin levels in corn....."CB method"

The best solution to prevent formation of aflatoxin is to avoid the high moisture, high humidity, and warm temperature conditions that allow molds like *A. flavus* to grow and produce toxins. Once aflatoxin is formed, however, ammoniation appears promising for detoxification. Also, ammonia may have potential as a prophylaxis since it can kill the molds that produce poisons.

- 3225 • Release of Bound Trypsin Inhibitors in Soybeans
by *Rhizopus oligosporus*
Hwa L. Wang, Janet B. Vespa, and C. W. Hesseltine
J. Nutr. 102(11): 1495-1499. November 1972

Activity of soybean trypsin inhibitors (SBTI) of boiled soybeans fermented by *Rhizopus oligosporus* Saito was studied to establish their nature. Extracts prepared from fermented boiled soybeans showed higher trypsin-inhibiting activity than extracts prepared from boiled soybeans. The extractable SBTI increased as the fermentation progressed, and reached a maximum after 48 hours of incubation; thereafter, SBTI activity decreased. The increased trypsin inhibitor was not synthesized by the mold, because no inhibitory activity was found in the culture filtrates of mold grown in milk or wheat media. Increase of trypsin-inhibitory activity was also noted when heated soybeans were treated with partially purified extracellular proteases by *R. oligosporus*. It is, therefore, apparent that an active trypsin inhibitor was liberated from a heat-resistant, inactive, bound form by *R. oligosporus* proteases. Once released, the inhibitor was readily inactivated by heat. *Rhizopus oligosporus* protease was also found to inactivate crystalline SBTI. Therefore, SBTI activity observed in boiled soybeans either fermented by *R. oligosporus* or treated with *R. oligosporus* enzymes came from released SBTI and from SBTI not inactivated by the mold enzymes.

- 3226 • Ochratoxin Synthesis by *Penicillium* Species
A. Ciegler, D. I. Fennell, H.-J. Mintzlaff,¹ and
L. Leistner¹
(¹Institut für Bakteriologie und Histologie, Kulmbach,
Germany)
Naturwissenschaften 59(8): 365-366. August 1972

During the course of a survey of the mycotoxin-producing potential of *Penicillia* isolated from mold-fermented sausage, 17 of 422 cultures were found capable of ochratoxin A production. These isolates represent three and possibly four species, additional to *Penicillium viridicatum* that can synthesize this mycotoxin: *P. commune*, *P. purpurescens*, *P. variable*, and *P. cyclopium*. However, none of these isolates produced ochratoxin on sausage.

- 3227 • Rigid Urethane Foams from Hydroxymethylated Linseed Oil and Polyol Esters
T. H. Khoe, F. H. Otey, and E. N. Frankel
J. Amer. Oil Chem. Soc. 49(11): 615-618. November 1972

Rigid urethane foams were prepared from hydroxymethylated linseed oil and its esters of glycerol, trimethylolpropane, and pentaerythritol. These polyols were made by selective hydroformylation with a rhodium-triphenylphosphine catalyst followed by catalytic hydrogenation with Raney nickel. Although the hydroxymethylated linseed monoglyceride by itself yielded a satisfactory foam, better foams were made from all hydroxymethylated linseed derivatives when blended with a low-molecular weight commercial polyol. Linseed-derived foams were compared with foams from equivalent formulations of hydroxymethylated monoolein and castor oil. Hydroxymethylated products yielded polyurethane foams meeting the requirements of commercial products with respect to density, compressive strength, and dimensional stability.

- 3228 • A Micromethod to Generate and Collect Odor Constituents from Heated Cooking Oils
E. Selke, W. K. Rohwedder, and H. J. Dutton
J. Amer. Oil Chem. Soc. 49(11): 636-640. November 1972

A small stainless steel reactor, about one-millionth the volume of a home kitchen, was built to generate odors from cooking oils heated to deep fat frying temperatures. This "microroom" was designed so that volatiles could be collected from 1-5 ml. of heated oils (193° C.) directly on a gas chromatographic column, cooled to -60° C., and subsequently separated by temperature programming up to 250° C. Evaluations showed that heated oil odors from the microroom were similar to those room odors produced by heating to 193° C. 300 ml. of cooking oil in an open vessel; exposure to subambient conditions did not affect the separation efficiency of the gas chromatographic column. Provisions were made for three independent means of effluent monitoring: flame ionization detection, odor analyses, and mass spectrometry.

- 3229 • Reductive Ozonolysis of Soybean Oil: Laboratory Optimization of Process Variables
P. E. Throckmorton¹ and E. H. Pryde
(¹Ashland Oil Inc., Columbus, Ohio)
J. Amer. Oil Chem. Soc. 49(11): 641-642. November 1972

Statistically designed experiments were carried out to determine the effect of reaction variables in the reductive ozonolysis of soybean oil to azelaaldehydic glyceride methyl acetal. Yields of this acetal were essentially quantitative under optimum conditions, which include a 1:1 mixture of acetic acid and butanol as solvent, a solvent:oil ratio of 1.5:1, and hydrogenation at 150 p.s.i.g. and 50° C. with a palladium-on-charcoal catalyst.

- 3230 • Pilot Run, Plant Design and Cost Analysis for Reductive Ozonolysis of Methyl Soyate
 P. E. Throckmorton¹ and E. H. Pryde
 (¹Ashland Oil Inc., Columbus, Ohio)
 J. Amer. Oil Chem. Soc. 49(11): 643-648. November 1972

Preparation of methyl azelaaldehyde dimethyl acetal (MAzDA) from methyl soyate was investigated on a pilot scale via sequence ozonization, hydrogenation, acetalization, and fractional distillation. A water-methyl soyate emulsion for the ozonization step was preferred to methanolic solution or neat methyl soyate for reasons of cost and safety. Ozonization of the water-methyl soyate emulsion (1.63:1 ratio) in a six-plate sieve tower produced 1,271 pounds of aqueous peroxidic emulsion during 12 days of continuous operation. Because a continuous hydrogenation facility was not available, reduction was done in 200-pound batches. Since batch hydrogenation of the peroxidic emulsion in this quantity was difficult to control and optimum conditions were difficult to maintain, maximum yield of the product was only 56%. The average yield for seven batches was 48.3%. However, laboratory hydrogenation under optimum conditions of periodic samples taken from the sieve tower discharge indicated an overall yield of 74.5% (average of eight monitor samples). A plant designed to produce 10 million pounds annually should be capable of producing MAzDA at a total manufacturing cost of 39 cents/pound or a net manufacturing cost of 27 cents/pound with byproduct credit conservatively estimated. Methyl soyate ozonolysis products are not sensitive to detonation, and their exothermic decomposition is greatly moderated by the presence of water.

- 3231 • Gas Chromatograms of Synthetic Liquid Waxes Prepared from Seed Triglycerides of *Limnanthes*, *Crambe* and *Lunaria*
 Thomas K. Miwa
 J. Amer. Oil Chem. Soc. 49(11): 673-674. November 1972

Compositions of synthetic liquid waxes derived from erucic-containing seed oils vary considerably. These differences, when determined by gas chromatography, allow "fingerprint" identification of the source of oil.

- 3232 • Spectrophotometric Cysteine Analysis
 James F. Cavins, Larry H. Krull, Mendel Friedman,
 Donald E. Gibbs, and Goerge E. Inglett
 J. Agr. Food Chem. 20(6): 1124-1126. November-December 1972

Procedures have been developed for estimating cystine content of proteins by reducing disulfide bonds with mercaptoethanol and selectively alkylating the generated sulfhydryl groups with 4-vinylpyridine or 2-vinylquinoline. 4-Vinylpyridine reacts with cysteine to produce *S*- β -(4-pyridylethyl)-cysteine (Pe-cysteine), which can be determined in protein hydrolyzates either by ion-exchange chromatography or ultraviolet spectrophotometry.

Pe-cysteine cannot be determined spectrophotometrically in the intact protein, since the absorptivity varies with size and composition of the protein. 2-Vinylquinoline reacts with liberated sulfhydryls under conditions similar to those for 4-vinylpyridine approximately half as fast to produce *S*-2-(2-quinolyylethyl)-L-cysteine (Qe-cysteine). Qe-cysteine absorbs at 318 nm with a molar absorptivity of 10,000 in 0.1 *N* acetic acid; since it is not affected by composition or size, spectrophotometric analysis can be made on solutions of the intact protein, as well as on its hydrolyzate.

- 3233 • Effect of Southern Corn Leaf Blight on Composition and Selected Physical Characteristics of Corn
James F. Cavins, Ordean L. Brekke, Edward L. Griffin, Jr., and George E. Inglett
J. Agr. Food Chem. 20(6): 1146-1149. November-December 1972

The 1970 corn crop was significantly affected by southern corn leaf blight. We analyzed heavily damaged, moderately damaged, and undamaged kernels from blight-damaged ears of corn. The kernels were generally smaller in size and lower in weight, and the grain was lower in test weight as blight damage increased. Protein, ash, and fiber content increased with increased blight damage while oil, starch, and pentosan content decreased. In general, amino acid data agreed favorably with that found for normal corn from years when no blight was present.

- 3234 • Lipid Composition of *Azotobacter vinelandii* in which the Internal Membrane Network is Induced or Repressed
Leon Marcus¹ and Tsuneo Kaneshiro
(¹Loyola University (Chicago), Stritch School of Medicine, Maywood, Ill.)
Biochim. Biophys. Acta 288(2): 296-303. November 1972

A vast internal membranous network in addition to the cytoplasmic membrane is induced in *Azotobacter vinelandii* simultaneously with the induction of the N₂-fixing enzymes. This membrane network is absent in *Azotobacter* growing with a fixed nitrogen source, e.g., ammonia. This report compares the lipid composition of *Azotobacter* grown under internal membrane-induced and -repressed conditions. Although the total lipid content of the two types of cells is identical, cells possessing internal membranes contain (1) 30% more total phospholipid, (2) 50% more coenzyme Q, (3) 80% less neutral lipid, and (4) 50% less anionic phospholipid (e.g., phosphatidyl-glycerol). The increased phospholipid (mostly amphoteric phosphatidyl-ethanolamine) and coenzyme Q content of nitrogenase-induced cells correlate with greater respiratory activity, which may serve to protect O₂-labile nitrogenases.

- 3235* • **Molds & Mycotoxins. How Good Are Our Assay Methods?**
 Odette L. Shotwell
In "Master Manual on Molds & Mycotoxins," pp. 30a-33a
 [included as 67-page insert in Farm Technology/Agri-Fieldman
 28(5)]. Fall 1972

Analytical methods for mycotoxins should be designed so that contaminated foods and feeds can be readily identified and prevented from reaching the market. The mycotoxin causing the greatest concern in the United States is aflatoxin. Methods of aflatoxin analyses fall into three categories: (1) Visual inspection that serves to locate lots of commodities which are likely to be contaminated with aflatoxin. (2) Rapid screening procedures that determine the presence or absence of the toxin, but not the levels present. (3) Finally, lengthy procedures that measure actual amounts of toxin in agricultural commodities. A limiting factor in the reliability of mycotoxin assays is sample size. When a mycotoxin appears to be present in a food or feed, its presence should be confirmed by tests based on either physical or chemical properties, or both.

- 3236* • **Glyceride Chirality**
 C. R. Smith, Jr.
 Top. Lipid Chem. 3: 89-124. 1972

The purpose of this chapter is to review the development of knowledge about glyceride chirality and to assess the current status of this problem. The chapter is not concerned with chiral centres that occur in acyl or alkyl substituents of glycerides, but only with chirality of the glycerol moiety per se. Although the emphasis is mainly on neutral glycerolipids, there is necessarily some reference to glycerophosphatides.

- 3237 • **Poisons from Molds. Some New Thoughts on an Old Problem**
 E. B. Lillehoj, Odette Shotwell, and C. W. Hesseltine
 Crops & Soils 22(3): 15-16. December 1972

Historical implications of mycotoxicoses are considered and current concepts of control emphasized. Variation of moisture, temperature, aeration, substrate, and genetic conditions are evaluated in the context of environmental factors contributing to the control of mold development on agricultural commodities. Mycotoxins in mold-contaminated forages, particularly occurrence and implication of patulin, are reviewed.

- 3238 • Graft Copolymers of Starch with Mixtures of Acrylamide and the Nitric Acid Salt of Dimethylaminoethyl Methacrylate
George F. Fanta, Robert C. Burr, W. M. Doane, and C. R. Russell
J. Appl. Polym. Sci. 16(11): 2835-2845. November 1972

Mixtures of acrylamide and the nitric acid salt of dimethylaminoethyl methacrylate (DMAEMA·HNO₃) have been graft polymerized onto unmodified wheat starch with ferrous ammonium sulfate-hydrogen peroxide initiation. Graft polymerizations were carried out with both unswollen starch granules and granules that had been swollen by heating in water to 60° C. Ungrafted synthetic polymers were removed from graft copolymers by cold-water extraction and were characterized by their \bar{M}_n and DMAEMA·HNO₃ content. Graft copolymers were characterized with respect to percent add-on, \bar{M}_n and DMAEMA·HNO₃ content of grafted polymer, and grafting frequency.ⁿ Ungrafted synthetic polymers contained a mole percentage of DMAEMA·HNO₃ equal to or greater than that present in the initial monomer mixtures; whereas in most grafted polymers the mole-% DMAEMA·HNO₃ in the grafted branches was less than that in the starting monomers.

At all monomer ratios examined, polymer grafted to swollen starch granules contained a higher percentage of DMAEMA·HNO₃ than polymer grafted to unswollen starch. The influence of starch granule swelling on the molecular weight and frequency of grafted branches was correlated with the composition of the initial monomer mixture. The effect of granule swelling on graft copolymer structure was minimal when 25-30 mole-% DMAEMA·HNO₃ was used. In an acetonitrile-water solvent system, reactions with 20 and 50 mole-% DMAEMA·HNO₃ produced graft copolymers with less DMAEMA·HNO₃ in grafted branches than corresponding graft polymerizations run in water. The flocculation of 3% aqueous suspensions of diatomaceous silica was examined with selected starch graft copolymers.

- 3239 • Scanning Electron Microscopy of Ascospores of *Schwanniomyces*
C. P. Kurtzman, M. J. Smiley, and F. L. Baker
J. Bacteriol. 112(3): 1380-1382. December 1972

Ascospores of the four recognized species of *Schwanniomyces* were examined by scanning electron microscopy. Spores of *S. alluvius*, *S. castelli*, and *S. occidentalis*, which were essentially identical, had abundant, long protuberances and wide, thin equatorial rings. The two known strains of *S. persoonii* differed from the other species as well as from each other. One strain had spores with a wide ring but only a few short protuberances; spores from the second strain were covered with craterlike depressions and had a narrow ring. Also examined were spores of *Schwanniomyces hominis* (= *Saccharomyces rosei*) which lacked a ring and were covered with short irregularly shaped protuberances, a finding consistent with the morphology of spores from other strains of *Saccharomyces rosei*.

3240 • Aflatoxin: Detection and Determination

[O. L. Shotwell]

North. Reg. Res. Lab.

U.S. Agr. Res. Serv., CA-NRRL-37, 2 pp. December 1972

[Processed]

Methods of aflatoxin analysis of corn fall into three categories: Visual inspection of kernels under black light or ultraviolet light (365 nm.) serves to locate lots that may contain aflatoxin. Rapid screening procedures determine the presence or absence of the toxin, but they do not determine the levels of toxin present. Finally, rather lengthy procedures are available to measure actual amounts of toxin in corn.

3242 • Cereals as a Future Source of Industrial Energy

Dwight L. Miller

Proc. Seventh Nat. Conf. Wheat Util. Res., held at Manhattan, Kansas, November 3-5, 1971. North. Reg. Res. Lab., U.S. Agr.

Res. Serv., ARS-NC-1, pp. 1-8. July 1972

Cereal grains and in fact most agricultural raw materials, with the possible exception of wood, have been little used or have received little attention as U.S. industrial energy sources. Yet, cereals provide directly or indirectly the major portion of approximately 1,000 trillion B.t.u. required per year by the population and at least an equal amount for domestic animals. The possibilities offered by wheat and other cereal grains in supplying the spiraling energy demands justify major considerations. Agricultural products represent renewable energy in contrast to such nonrenewable materials as oil, gas, and coal on which we have so long depended.

3243 • Fuel Alcohol from Wheat

Dwight L. Miller

Proc. Seventh Nat. Conf. Wheat Util. Res., held at Manhattan, Kansas, November 3-5, 1971. North. Reg. Res. Lab., U.S. Agr.

Res. Serv., ARS-NC-1, pp. 9-21. July 1972

Wheat has primarily been used as a food grain, and except in times of national emergencies or unusual price situations, only a small fraction of total U.S. production has been consumed as feed and used for industrial purposes. This discussion relates changes that have occurred in the past 2 years and updates overall alcohol production and use economics.

3244 • Cereal Starch and Flour Products in Rubber and Paper

C. R. Russell

Proc. Seventh Nat. Conf. Wheat Util. Res., held at Manhattan, Kansas, November 3-5, 1971. North. Reg. Res. Lab., U.S. Agr. Res. Serv., ARS-NC-1, pp. 22-34. July 1972

Processes have been developed for producing starch-filled rubber in either powdered form or in conventional slab form. Both forms can be processed and vulcanized readily to give finished rubber goods wherein the starch serves as a highly effective reinforcing agent. Unlike rubber reinforced with carbon black, starch-reinforced rubber can be made in white or brightly colored forms. The powdered rubber is especially attractive because, like powdered plastics, it can be mixed with curing agents and other additives and injection molded more economically than slab rubber.

Cationic wheat and corn flour were produced at a rate of 300 pounds per hour in a semicommercial pilot plant by treatment of the flour with ethylenimine and gaseous hydrogen chloride. As wet-end additives in papermaking these flour products are as effective as premium quality cationic starches in retaining filler and in improving dry strength and can be made at lesser cost.

Cationic graft terpolymers of starch were developed which on a cost-performance basis appear to have an advantage over commercial polymers as retention aids in papermaking.

3245 • Effect of Variety and Processing on Wheat and Triticale Proteins

J. S. Wall, J. A. Bietz, F. R. Huebner, R. A. Anderson, and A. C. Stringfellow

Proc. Seventh Nat. Conf. Wheat Util. Res., held at Manhattan, Kansas, November 3-5, 1971. North. Reg. Res. Lab., U.S. Agr. Res. Serv., ARS-NC-1, pp. 119-135. July 1972

Protein differences among wheat varieties, including semidwarf wheats, and among triticale varieties greatly affect the properties and potential uses of flours from these grains. Amounts and structure of gliadin, glutenin, and acetic acid-insoluble protein in these various grains also affect dough performance and nutritional value. New techniques that measure molecular size of intact molecules and of polypeptide chains, obtained after cleavage of disulfide bonds, provide information concerning genetic basis for varietal differences among glutenins. Air classification and wet-milling of wheat and triticale flours produce protein concentrates that serve as nutritional and functional supplements in foods. Flour from one triticale variety gave exceptionally good yields of a high-protein fraction after air classification and also wet-milled into gluten and starch fractions having commercial potential.

3246 • Cross-Reactions of Polysaccharides of *Lipomyces* in Antipneumococcal and Other Antisera

Michael Heidelberger¹ and Morey E. Slodki

(¹New York University Medical Center, New York)

Carbohyd. Res. 24(2): 401-407. October-1972

Cross-reactions of the extracellular polysaccharides of *Lipomyces lipoferus* and *Lipomyces starkeyi* are described, in some instances quantitatively. Nonreducing end-groups of D-glucuronic acid appear to account for most of the explicable reactions of the polysaccharide of *L. lipoferus*, whereas nonreducing end-groups of D-galactose account for many of those of *L. starkeyi*. Because of its strong cross-reaction in antipneumococcal type II serum, the polysaccharide of *L. starkeyi* is also presumed to have a portion of its D-glucuronic acid in the form of nonreducing end-groups.

3247* • Seed Proteins in Perspective

George E. Inglett

In "Symposium: Seed Proteins," ed. G. E. Inglett, chap. 1, pp. 1-4. Westport, Conn. 1972

As the population on earth continues to explode, increased production worldwide of seed with improved nutritive value is mandatory. Seed crops represent food--sometimes, seeds are used in their near native form in the unsophisticated diet. Foods prepared from processed seeds in more highly cultured societies usually give little resemblance to the original grains. There are many facets of protein synthesis, properties, and processes associated with our large worldwide seed crops. In this symposium participants discussed some of the major seeds and illustrated where basic and applied research could be used for the betterment of mankind.

3248* • Corn Proteins Related to Grain Processing and Nutritional Value of Products

George E. Inglett

In "Symposium: Seed Proteins," ed. G. E. Inglett, chap. 13, pp. 176-192. Westport, Conn. 1972

Proteins constitute nearly 10% of whole corn kernels. These substances in corn are classified according to their solubility into albumins, globulins, prolamines, and glutelins. They are particularly important in understanding the nutritional composition of corn, its processing, and stability to final products. Microscopy of endosperm proteins in ordinary corn hybrids reveals protein bodies that are sites of zein deposition. *Opaque-2* corn has smaller bodies of zein, which are observed only under electron microscopy. Protein bodies of immature corn have been isolated by zonal sedimentation and identified as zein. Corn processed by dry milling gives

nearly one-third hominy feed. The corn germ, which ultimately finds its way into this animal feed, is of good nutritional quality and has prospects for further processing into human foods.

3249* • Soybean Ultrastructure and Its Relationship to Processing

Walter J. Wolf

In "Symposium: Seed Proteins," ed. G. E. Inglett, chap. 16,
pp. 231-241. Westport, Conn. 1972

Studies on the ultrastructure of soybeans lag considerably behind similar research on other seeds including wheat, corn, cottonseed, and peanuts. Although the outlines of soybean ultrastructure based on optical microscopy were described more than 50 years ago, little additional work was done until the early 1960's when more sophisticated tools and techniques, such as the electron microscope, became readily available. Since then, a few investigators have filled in some of the details of soybean structure, but much more research is needed. The relationship of soybean ultrastructure to processing is sketchy, and little of the known information has been applied to developing new processing methods. This chapter summarizes present knowledge of soybean ultrastructure and attempts to relate this information to changes in cellular structure during processing of soybean products.

REPUBLICATION

- 3005* • Stärke in Kautschuk: Pulverförmige Elastomere aus stärkeumhüllten Latexpartikeln [In German. Starch in Rubber: Powder-Forming Elastomer from Starch-Covered Latex Particles]
 R. A. Buchanan, H. C. Katz, C. R. Russell, and C. E. Rist
 Gummi Asbest Kunstst. 25(7): 636-640, 664. July 1972

This article originally was published under the title "Starch in Rubber. Powdered Elastomers from Starch-Encased Latex Particles" in *Rubber Journal* 153(10): 28, 30, 32, 35, 88-91, October 1971.

UNOFFICIAL PUBLICATIONS

Listing of Publications and Patents of the Northern Regional Research Laboratory would not be complete without including some unofficial publications. These are writings by members of the Northern Laboratory staff, and, although written from previously published official material, are of a public service value from the standpoint of review and updating of the literature.

Soybeans as a Food Source

W. J. Wolf and J. C. Cowan

CRC Monotopics Series, 86 pp. Cleveland, Ohio. 1971

This paper was originally published, under the same title, in *Critical Reviews in Food Technology* 2(1): 81-158, April 1971.

Solubility Parameters--Their Origin and Use

E. B. Bagley

Short Course "Solubility Parameters. Their Origin and Use," Kent State University, Kent, Ohio, July 10-14, 1972 [Sponsored by Paint Industry Education Bureau, Washington, D.C.], pp. 1-53. 1972

CONTRACT AND GRANT RESEARCH PUBLICATIONS

[Report of research work done by an outside agency under contract with the U.S. Department of Agriculture and supervised by the Northern Regional Research Laboratory.]

- 248-C* • Composition of Polymerized Linseed Oil Bodied by a Molten Eutectic Salt Mixture
A. E. Rheineck and S. N. Koley
North Dakota State University, Fargo
Fette Seifen Anstrichm. 74(6): 347-353. June 1972
- 251-C* • Selective Hydrogenation Catalyzed by Polymeric Palladium and Platinum Complexes
Harold S. Bruner and John C. Bailar, Jr.
University of Illinois, Urbana
J. Amer. Oil Chem. Soc. 49(9): 533-534. September 1972
- 252-C* • Determination of Lysine in Cereal Proteins
Jose Madrid Concon
University of Kentucky Research Foundation, Lexington
In "Symposium: Seed Proteins," ed. G. E. Inglett, chap. 22, pp. 292-311. Westport, Conn. 1972

[Report of research done by an outside agency under a grant from the U.S. Department of Agriculture and supervised by the Northern Regional Research Laboratory.]

- 125-G* • Light Scattering and Electron Microscopic Characterization of Amylose Films
J. Borch, R. Muggli, A. Sarko, and R. H. Marchessault
State University College of Forestry, Syracuse, New York
J. Appl. Phys. 42(12): 4570-4579. November 1971
- 126-G* • Synthesis and Acid-Catalyzed Hydrolysis of 3-O-Glycosyl-L-Serine and -Threonine
L. P. Egan,¹ J. R. Vercellotti,² and W. T. Lowry²
¹University of Tennessee, Knoxville; ²Virginia Polytechnic Institute and State University, Blacksburg
Carbohyd. Res. 23(2): 261-273. July 1972

- 127-G* • Substrate Specificity of Pullulanase
Mukhtar Abdullah and Dexter French
Iowa State University, Ames
Arch. Biochem. Biophys. 137(2): 483-493. April 1970

- 128-G* • Negligible Evaporation Retardation by Oxyethylene
Docosanol Under Static Conditions
Paul A. Hartman and Judith A. Weber
Iowa State University, Ames
Appl. Microbiol. 24(3): 508-509. September 1972

[Report of research work supported with funds provided by the U.S. Department of Agriculture under the authority of U.S. Public Law 480, 83rd Congress, and sponsored by the Northern Regional Research Laboratory.]

- 351-F • Binding of Soybean Agglutinin by Normal and
Trypsin-Treated Red Blood Cells
Julius A. Gordon, Nathan Sharon, and Halina Lis
Weizmann Institute of Science, Rehovoth, Israel
Biochim. Biophys. Acta 264(2): 387-391. April 1972

- 352-F • Internal Glycosides Present in Hydrolyzates of
O-(2-Hydroxyethyl)starch: Spectroscopic Characterization
of 3,4,6-Tri-O-acetyl-1,2-O-ethylene- β -D-glucopyranose
and 3,5,6-Tri-O-acetyl-1,2-O-ethylene- α -D-glucofuranose
H. C. Srivastava,¹ A. S. Chaudhari,¹ N. M. Doshi,¹
Derek Horton,² and Joseph D. Wander²
(¹ Ahmedabad Textile Industry's Research Association,
Ahmedabad, India; ² The Ohio State University, Columbus)
Carbohydr. Res. 24(1): 188-191. September 1972

July-December 1972

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PATENTS

[These patents are assigned to the Secretary of Agriculture. Copies of patents may be purchased (50 cents each) from the Commissioner of Patents, U.S. Patent Office, Washington, D.C. 20231. Order by number, do not send stamps.]

Glossy Finish Linseed Water Emulsion Paints and Nonagglomerated Pigment Composition for Said Paints

Lambertus H. Princen

U.S. Patent 3,681,099. August 1, 1972

Stable aqueous emulsion linseed oil housepaints having a PVC of 28% and that dry to nonflat, i.e., semigloss or highly glossy, finishes are produced by first dispersing the metallic oxide pigment(s) in hexane, benzene, chloroform, or similar low-boiling solvent containing emulsifiers and sufficient linseed oil to fully coat the unaggregated 0.25 μ pigment particles; the resulting dispersion or suspension is then gently emulsified in water. Evaporation of the low-boiling solvent followed by the incorporation of additional oil provides the improved aqueous linseed emulsion paint of the invention.

LICENSING OF PATENTS

Many inventions and discoveries of the Northern Laboratory are covered by patents assigned to the Secretary of Agriculture.

Assigned patents are available for use by business and industry under either exclusive or non-exclusive licenses. Conditions

applicable to the granting of licenses are set forth in the Federal Register, May 14, 1970 [35(94): 7493-7495]. Further information can be obtained from the Administrator, Agricultural Research Service, U.S. Department of Agriculture, Washington, D.C. 20250.

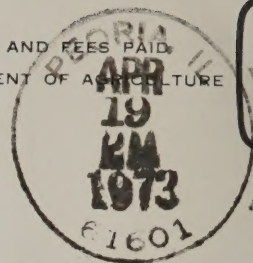
The Northern Regional Research Laboratory is part of the Agricultural Research Service of the U.S. Department of Agriculture. Congress in 1938 authorized four regional laboratories to conduct broad and complex investigations in the field of chemistry and related physical sciences to expand and improve the marketability of agricultural commodities. A fifth laboratory was completed in 1969 at Athens, Georgia. The addresses and commodities covered are:

<u>Laboratory</u>	<u>Principal Fields of Research</u>
<p>Eastern Regional Research Laboratory 600 East Mermaid Lane Philadelphia, Pennsylvania 19118</p>	<p>Animal fats; dairy products; deciduous fruits; hides and leather; maple sap and syrup; meat and meat byproducts; potatoes and other vegetables.</p>
<p>Northern Regional Research Laboratory 1815 North University Street Peoria, Illinois 61604</p>	<p>Cereal grains: corn, wheat, grain sorghum, barley, and oats; oilseeds: soybean, flaxseed, and erucic acid-containing oilseeds; and new crops.</p>
<p>Richard B. Russell Agricultural Research Center P. O. Box 5677 Athens, Georgia 30604</p>	<p>Southeastern poultry, fruits, and vegetables; pecans and peanuts; forages and feeds; sunflower as an oilseed; pork; and tobacco.</p>
<p>Southern Regional Research Laboratory P. O. Box 19687 New Orleans, Louisiana 70179</p>	<p>Cotton and cottonseed; peanuts; rice; sweet potatoes; and sugarcane.</p>
<p>Western Regional Research Laboratory Berkeley, California 94710</p>	<p>Western fruits, nuts, vegetables, oilseeds, and rice; poultry products; forage crops; wheat and barley; wool and mohair; dry beans and peas; castor; and safflower.</p>

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